The Canadian Entomologist.

LXXVII MARCH, 1945 No. 3

A NEW CANADIAN SPECIES OF *SYNDIPNUS*, WITH RECORDS OF OTHER SPECIES (HYMENOPTERA, ICHNEUMONIDAE) *

BY G. S. WALLEY,
Ottawa, Ont.

Syndipnus phygadeuontoides n. sp.

This species conforms very well with the generic diagnosis given in my previous paper[1], except in having the thoracic and abdominal sculpture greatly reduced. In the key to species it traces to *ungavae* Wly., but differs from that species, as well as from all others included in the key, in having the antennae unusually short, with the flagellar segments fewer in number and considerably stouter than in any of these species. In addition, in *phygadeuontoides* the thorax is notably elongate, with the mesoscutum strongly flattened, and the legs, especially the femora, are unusually short and stout; these characteristics, in conjunction with the generally black body color, being suggestive of some of the smaller Phygadeuonini.

In Schmiedeknecht's key[2] to the European species it traces best, though not agreeing entirely with all key characters, to *Synodites contractus* Holmg., a species also exhibiting unusually short stout antennae, but differing from *phygadeuontoides* in having the thorax stout and elevated above, and in other details of structure and color.

The single male from Stupart Bay, Que., referred to in my synopsis, following the description of *ungavae*, is not unlike the present species in several respects, notably in the lack of pronounced thoracic and abdominal sculpture, the rather elongate thorax, and its general blackish body color.

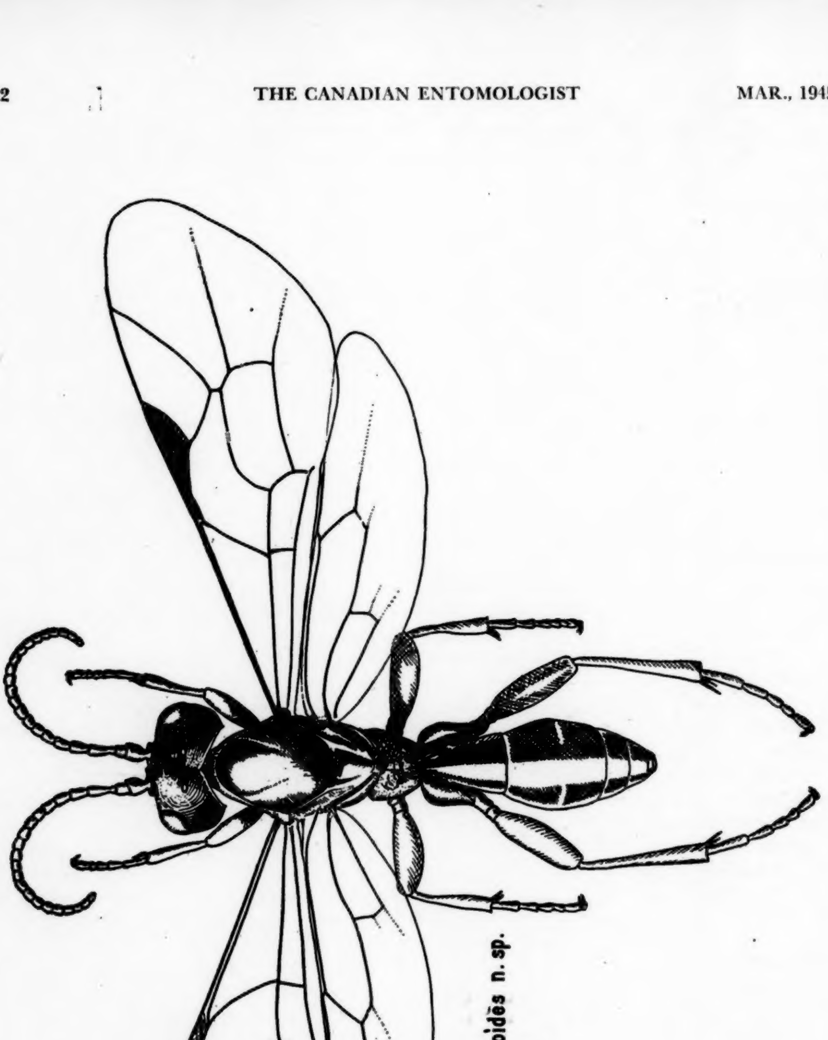
Female—Length 4 mm. Head distinctly broader than thorax; temples broad, rounded, moderately receding; eyes parallel within; face a little more than twice as broad as long; clypeus fully twice as broad as long, the thin lateral angles of its free margin rather distinctly produced; malar space three-fourths basal width of mandible; ocelli small; ocellocular line twice as long as diameter of a lateral ocellus; median V-shaped sulcus of vertex distinct; antenna 22-segmented, short, stout, all segments of flagellum beyond basal 4 or 5 only very slightly longer than thick; head shining, with more or less fine alutaceous sculpture especially on face, the latter and clypeus sparsely punctured.

Thorax rather narrow and elongate with greatest depth only slightly greater than width at widest portion; pronotum in greater part with numerous fine irregular rugulae; mesoscutum rather strongly flattened except in front, polished and impunctate; notaulices distinct, but short, with a little fine granular sculpture at anterior extremities; scutellum polished, with a few minute punctures; mesopleuron mostly smooth and shining, with more or less fine rugulose sculpture along upper margin; prepectoral carina distinct and continuing to anterior margin of mesopleuron; metapleuron entirely irregularly rugulose and with a few shallow poorly defined punctures; propodeum rather evenly convex, with a small impression at middle at extreme base; narrow basal portion of propodeum smooth, elswhere propodeum with numerous irregular anastamosing rugulae which become slightly coarser on posterior portion and which obscure all but a few traces of the usual longitudinal carinae; femora

*Contribution No. 2333, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

[1]Can. Ent., LXXII, 135, 1940.

[2]Opus. Ichneum., V, 2766, 1913.



Syndipnus phygadeuontoides n. sp.
(Holotype, ♀)

rather stout; radius arising from middle of stigma; intercubitus one-half as long as abcissa of cubitus; nervulus slightly postfurcal; second abcissa of discoideus distinctly longer than third; nervellus perpendicular, emitting discoidella slightly below middle.

Abdomen rather broad at middle, tapering evenly to base and slightly compressed in apical portion; first tergite with median carinae present only at base; all tergites smooth and shining except for faint reticulate sculpture on the first two tergites especially in basal portions; variolae of second tergite very faint; suture between second and third tergites erased in median portion; sheath broad, only slightly exserted.

Body black, including 2 basal segments of antenna, all coxae, base of trochanters, and abdominal tergites except as noted below; flagellum brownish-black; clypeus and mandibles except apices of latter, yellow; palpi brownish; tegula, wing bases and humeral angle of pronotum pale yellowish; legs brownish, the femora almost black, except apices of four anterior femora which are narrowly sordid yellowish; stigma and veins brown, the former with a yellowish spot at base; wing membrane tinged with brownish; second and third tergites with a narrow pale line on posterior margins, except at middle of second tergite; apical margins of fourth and fifth tergites obscurely brownish; sides and apices of the three following tergites yellowish; venter yellowish, with large brownish patches on either side of sternites 2, 3 and 4; sheath brown.

Holotype—♀, Churchill, Man., July 24, 1937 (W. J. Brown, No. 5557 in Canadian National Collection, Ottawa, Ont.

Syndipnus probatus Wly.

This species, described from specimens taken at Plattsburg, N. Y., is represented by a female from Jockvale (Carleton Co.), Ont., June 1, 1935 (G. S. Walley) which differs from the type in being slightly larger (length 6 m.m.) and in having the abdominal tergites pure black except for paler margins of the apical tergites.

Syndipnus gaspesianus (Prov.)

An excellent series (35 ♂♂, 46 ♀♀) is now at hand, reared by Dr. C. E. Atwood, at Laniel, Que., June 1-8, 1941, from *Pikonema alaskensis* (Rohw.).

Syndipnus rubiginosus Wly.

Five additional specimens, reared from *Pikonema dimmockii* (Cress.) and *Pikonema alaskensis* (Rohw.) from Quebec and New Brunswick localities, have been received from officers of the Forest Insect Unit of the Division of Entomology. Also at hand are single males, without host data, from Alberton, P.E.I., June 17, 1940 (G. S. Walley), and Riding Mounting Park, Man., June 11, 1938 (W. J. Brown).

Syndipnus conformis (Holmg.)

This species, originally described[3] from Sweden, has not hitherto been reported from North America. A male and female from Atton's Lake, Cut Knife, Sask., June 3, 1940 (A. R. Brooks) agree so perfectly with the descriptions of *conformis* given by Holmgren and subsequent authors that I am constrained to identify them tentatively as such, notwithstanding the fact that I have at present no European examples for comparison.

In my key to the North American species[1] this species traces to couplet 3, and in general structure and color is very similar to the three species thereunder. It differs from *alaskensis* Wly. in having the face in both sexes with a large median yellow spot, the humeral angle of pronotum yellow, and the four anterior coxae yellow except at bases. From *lateralis* (Grav.) and *pannicularius* (Holmg.) it differs in facial maculation, and in the absence of a distinct unsculptured area on mesopleuron anterior to speculum, and in addition from the latter species in having a pair of well defined longitudinal carinae on the first tergite. From *lateralis* it may also be distinguished by the slightly broader malar space, more finely sculptured face, and in having the nervellus broken slightly below the middle.

---

[3]Svensk. Vet.-Akad. Handl., I, 183, 1855.

CONDITIONS GOVERNING THE DISTRIBUTION OF INSECTS IN THE FREE ATMOSPHERE*

BY W. G. WELLINGTON,
Meteorological Service of Canada, Toronto, Ont.

PART III: THERMAL CONVECTION.

Introduction

Atmospheric convection is a process which involves the more or less vertical motion of air currents. During the discussion of winds (Part II), the writer indicated that winged insects inactivated by low temperatures, or wingless insects within any temperature zone, required vertical currents for support, and for assistance in horizontal transport, rather than horizontal currents alone, regardless of the strength of the latter currents. In the following pages, the process known as thermal convection will be considered as a means for the vertical and horizontal distribution of insects.

The Mechanism of Thermal Convection

Perhaps the most important type of convection, from the standpoint of the distribution of insects, is thermal convection, which begins at or near the ground. It is this type which usually is responsible for the formation of small wool-pack or fine-weather cumulus cloud in fairly moist air, or, if coupled with other processes aloft, for the production of heat thunderstorms. In drier air, such currents, then termed "dry thermals,' may occur without any cloud-formation.

Thermal convection is essentially a product of unequal surface heating. Throughout a sunny day, the air directly above a surface of low heat capacity (e. g., sand) becomes much warmer than air above any surrounding surfaces which may radiate heat more slowly (turf or forest areas). These small masses of heated air often are visible as shimmering "heat waves." If the surface wind speed is low, it is possible for several of these small masses of warmed air to coalesce, and eventually, the resultant "thermal bubble" is started upward through the surrounding cooler, denser air. An irregular, though closely spaced production of these bubbles of rising air constitutes a convection current, or thermal.

Under proper atmospheric conditions, thermal acceleration produces vertical velocities in these currents of the order of eight or more meters per second. Such velocities are ample for the vertical transport of the minute insects and weak fliers of the "plankton zone" type, which might be caught up in the thermal currents.

Insect Survival in Convection

Convection is the only process by which an insect is apt to be exposed to lethal atmospheric conditions. However, the very nature of the process ordinarily does not permit any insect transported by it to remain at any one level long enough to be endangered by unfavourable conditions. Previous experiments (Part I) indicated that a low temperature coupled with a high humidity provided the most lethal condition. Ordinarily, convection, under summer conditions in North America, is damped out before it reaches the height of the freezing level (3–4½ km.), so that, in the usual course of events, there is no chance for an insect to be subjected to such low temperatures.

However, there are many cases where the convective process continues well above the zero isotherm, either by a lowering of that temperature level, or by virtue of extremely unstable atmospheric conditions which cause convection to persist to great heights. To illustrate the latter case, one may point to heavy, swollen cumuli, or, as an extreme case, to a well-developed thundercloud, which may tower to 7 km. Particularly in the latter cloud, there is ample opportunity for an insect to be carried to a temperature of–20 degrees Centigrade or lower.

*This paper is the third of a series appearing in succeeding numbers of the *Canadian Entomologist*.

The air is saturated, and the survival index of such a cloud would appear to be low indeed.

It is apparent that some insects, particularly soft-bodied types, certainly would perish immediately if subjected to such conditions. However, it will be remembered (Part 1) that other insects withstood repeated freezing and thawing for short periods, even when coated with successive layers of ice. If this ability to withstand such conditions for successive 5-10 minute periods seems inadequate for survival, it should be noted that, while measured vertical velocities within a heavy cumulus may be anywhere between 7 and 20 meters per second, velocities of 26 meters per second have been recorded within a cumulonimbus, or thundercloud. It is unlikely that any insect would be held by such currents for 5 minutes at any one level within such a cloud.

Thunderclouds produce hailstones. The examination of these stones in section often shows them to have a concentric structure, giving evidence of repeated freezing and thawing. Since some insects evidently may survive equivalent experimental conditions (Part 1), and, in addition, will survive far more rapid pressure changes than can take place along the convective axes of the cloud, it is probable that they may survive several circuits through the storm conditions within the cloud. There is, of course, a danger of colliding with hailstones, or of becoming the nucleus of a large stone, with no chance of survival. On the whole, however, the transport-duration through such conditions is likely to be so short that insects, other than soft-bodied forms, have a good chance of survival in thunderstorm convection.

Periods of Insect Distribution by Convection

Thermal convection, over a region, is a diurnal phenomenon. The surface production of heated air, although irregular, tends to increase in rate towards early afternoon, and to decrease thereafter, as radiative cooling overbalances insolation. Except in the case of a heat thunderstorm, or where local peculiarities (e.g., cities or wooded areas) impart crepuscular effects, thermal convection dies down through the afternoon, so that the currents and their cloud-products normally dissipate by evening. Hence, it is evident that diurnal insect forms are more susceptible to transport to high altitudes (i.e., above the friction layer or the freezing level) than are insects active during other periods. Moreover, the maximum numbers of transported insects should be looked for at the maximum altitudes during the early afternoon period. Thereafter, as the processes decrease in intensity. the maximum altitude populated will diminish accordingly. Towards sunset, thermal conditions break down at the ground. However, currents still persist for a short time above the surface, up to a height of about 0.5 km. Thus, the diurnal aerial population produced by convection may be maintained at that height for a short time after sunset.

In the case of heat thunderstorms, which may continue activity into the evening, there is a possibility that, besides crepuscular insects caught up by the storm, some diurnal insects may still be found in the turbulent storm area, or in any upper circulation around it which is strong enough to sustain them. In addition to thunderstorms, cities or forested areas may act as thermal sources in the crepuscular period, as noted above.

This functioning of cities and wood-lots as thermal source-areas after sunset may be explained on the basis of radiative types. Darker-hued areas retain heat longer than do any surrounding areas of lighter colour and lower heat capacity, and, when insolation ceases at sunset, the stored heat is then liberated more slowly from them than from those areas of lower heat capacity. Hence, there are produced slowly-rising currents of warmer air over an isolated dark-coloured built-up or wooded area.

An excellent example of the effect of this change in convective source-areas upon the vertical distribution of insects is afforded by the feeding actions of the nighthawk, *Chordeiles minor,* at Toronto, Ontario. During the daylight

hours of days exhibiting convection, these birds restrict their feeding flights to the more open, grass-covered areas of the city. However, for about three hours after sunset, there is a marked shift of flight activity from the open areas to the more wooded or built-up sections of the city. This shift of feeding ranges takes place with great regularity throughout the summer months, and occurs each day independently of the presence or absence of any large-scale swarming of various species of insects.

Vertical Distribution of Insects by Convection

The maximum altitudes attainable by insects at any time may be predicted with considerable accuracy by a consideration of the indicated heights of convective processes in the atmosphere. Meteorologically, there is an upper limit to any such process, so that it is only necessary to consider existing air mass characteristics to determine the heights at which insects may be found on any day of convection. A consideration of such specific cases is outside the scope of this work, but it is possible to generalize, utilizing the common convective cloud-types for height-references.

Case (1) — Low cumuli or dry thermals

The upper limits of flattened, fair-weather cumuli usually are found below 3 km., and no convection takes place very far above the cloud-tops. Thus, in any area containing these clouds, or the equivalent dry thermal phenomena, it is apparent that insects will not be found above 3 km.

Case (2) — Towering cumuli and thunderclouds

Towering cumuli, which are the familiar tall, swollen cumuli of humid afternoons, seldom reach to heights above 5 km. On the other hand, a well-developed cumulonimbus, or thundercloud, may attain a height of 7 km., and there is good evidence that the spreading ice-crystal top of such a cloud may, in certain cases, reach to more than 9 km. above sea-level. Very little is known concerning the magnitude of the vertical currents above 7 km., in the diverging air of the top, but cases of severe turbulence as high as 10.5 km. have been reported by pilots (2). It would seem possible that insects could be found at these elevations, under such conditions within the cloud, if anyone cared to brave the dangers of the strong currents to search for them.

Horizontal Distribution of Insects by Convection

Although convection is the only process capable of producing any extensive vertical distribution of insects, it cannot be considered as an effective means of horizontal distribution. Thermal convection, by its very nature, is inclined to be irregular in the distribution of its source-areas relative to the ground. Moreover, the convective currents are, in themselves, not continuous cores of rising air, but consist of down-draught zones between the up-draughts. Therefore, it would appear that such convective processes lack the requirements of steadiness and area that are necessary for any appreciable horizontal transport of insects. Using thermal sources alone, man-made glider flights are of rather short duration, and the distances obtained are in no way applicable to insects borne inertly upon the same air currents.

The simplest statement of a range of transport is a multiplication of its possible duration by its average velocity. On this basis, there is possible a horizontal transport-duration of some eight hours by convection, if the currents build up in mid-morning and dissipate soon after sunset. In good convective weather, a low-altitude velocity of transport may be assumed to be about 25 km. per hour (15 m.p.h.) However, considering the scattered nature of the thermal source-areas, and the presence of down-draughts and ultimate deceleration within a thermal, the probable duration of "steady" transport is not more than about three hours.

The probable path of an insect borne along by a mid-morning current

would follow an erratic course as the insect was tossed indiscriminately from one type of current to another. During cloud-building, any gain in horizontal distance might be quickly nullified. It is unlikely that any insect would travel the 75 km. indicated by the three-hour transport-time. The majority would fall to earth very far short of this distance.

The writer believes that any horizontal transport of insects by convection must take place while the insects are within the zone of greatest activity of the process (i.e., within a thermal). He is committed to the belief that, within the plankton zone of the atmosphere, the vast majority of the insect population lies within the thermal columns, or other vertical currents. On the basis of this belief, the regions between the thermals would be sparsely populated with freed insects, or with a few terrestrial-zone insects ranging outside their territory. Upon the break-down of vertical processes, the subsiding plankton population would, of course, be more uniformly distributed.

Collections made by aeroplane cannot prove or disprove this contention, since the speed of an aircraft carries it swiftly through all thermal and non-thermal zones at a given level, so that the trap-operators can exercise no selective power between any such zones along a flight-level. The increasing availability of the helicopter will perhaps dispose of this stumbling-block, since, with such a machine, it should be possible to locate a thermal and cut back and forth across it at will. In the absence of any direct evidence from aircraft collections, the writer offers another insect-feeding bird as an indicator of the relative distribution of insects in the plankton zone during convection.

The chimney swift, *Chaetura pelagica,* is present in some numbers in the vicinity of Toronto. During convective weather, the early morning feeding-altitudes of the birds are seldom more than 50 meters over all types of ground-surfaces. As midday approaches, the feeding layer is extended from the ground to about 150 meters. At this time, the swifts have congregated over open farm-land, and the majority avoid the wood-lots within the feeding-range. In the early afternoon, at the convective peak, there is a division of the feeding bands. Many of the birds remain over the farm-land, within the 150-meter layer. On the other hand, it is common to observe feeding bands of 40-60 birds soaring in tight circles at heights up to at least 350 meters. When cumulus cloud is present, it is of particular interest to note that these circling bands remain consistently upwind below a particular cloud.

The writer offers the following explanation of this behaviour. In the early morning, convective activity is not well-developed, and there is little or no differentiation of radiative surfaces. Consequently, there is a fairly uniform aerial distribution of insects within the lowest layer of the atmosphere. Therefore, the birds feed over the whole area. Later in the day, as convection develops, insects are carried higher, and are present in greater numbers at higher altitudes over open-field thermal source-regions. Hence, there is a congregation of feeding swifts over the better-stocked areas. At the day's convective peak, the division of feeding levels may be explained by the fact that some birds remain to feed in the terrestrial zone, while other bands, beginning to feed within a thermal, follow it upward, and remain therein, presumably because there are more insects within the thermal than there are outside it. When cloud is present, it gives evidence that the birds actually are within the thermal, since they remain upwind below a cloud. No thermal is perpendicular to the ground, for it is inclined at an angle of less than 90 degrees as it drifts with the wind. Hence, any point within a thermal below its cloud will lie upwind from that cloud.

A heat thunderstorm might be considered as a special case, since it continues activity later in the day than do ordinary convective processes. It might be argued that the much stronger currents within the cloud would be more apt to retain an insect within the compass of their activity, and so transport it farther.

Some idea of the slight chances of any appreciable transport-duration or distance being gained through thunderstorm activity may be derived by considering the experience of an early aeronaut, who entered a well-developed storm during a free-balloon ascent (4). Upon entering the storm, the balloon was carried up and down for about ten circuits, during which time it was completely out of control. Within twenty minutes of the time of entry, it was tossed clear and landed, after having travelled about 5 km. cross-country through the storm. To evaluate the above experience, it is important to remember that the balloon was completely at the mercy of the currents.

The chief feature of an active thunderstorm which renders it a possible agency for insect distribution is its large area. The diameter of the base of an average cumulonimbus is about 16 km. (1). Through the specialized structure of the vertical currents around and within the cloud, it is conceivable that a diurnal or crepuscular insect could be drawn in at the front of the storm, and quickly deposited by the currents into the air behind the storm. This is one highly probable means of a rapid redistribution of large numbers of insects, particularly of alate forms active around the storm area, or in the path of the storm.

The average active duration of a heat thunderstorm unit is about three hours, after the building period, but as noted above, there is no indication that an insect would be retained within the storm area for very many minutes.

There may be some doubt that many insects are drawn into a thunderstorm by its vertical currents, since there is a tendency for most insects to cease flight and cling to some protected support during an increasing wind. In Part I, it was noted that Parman (3) described a severe storm which apparently decimated the muscoid flies of the area. The storm followed a rapidly falling pressure, as is usual with thunderstorms. In Part I, the writer pointed out that increased flight activity among the flies before the storm was, in all probability, another manifestation of barotaxis in Diptera. He further stated that the decrease in numbers probably came about partly through a rapid redistribution of flies which were air--borne at the time, and perhaps also through the death of some comatose flies in exposed places, through mechanical injury from heavy precipitation.

The increasing wind which blows toward an approaching thunderstorm is actually the main up-draught of the storm, while the strong gust out of the storm as it arrives overhead marks the path of the main down-draught of the circulation. Insects in active flight ahead of a storm are liable to be drawn in along the up-draught, and carried high into the cloud. The higher the flight-level of the insect, the more likely is this to occur, since the up-draught increases with height, both in velocity and in definition. Dipterous insects, responding to the rapidly falling pressure before the storm with greatly increased flight activity, are peculiarly vulnerable to sudden transport by this means. In fact, it is occasionally possible to see a fly being swept up into the cloud upon the up-draught. The writer observed this several times during July, 1944, near Toronto.

The ubiquitous chimney swift may be used as an indicator for the presence of air-borne insects around a thunderstorm. The writer frequently has observed swifts congregating ahead of an afternoon storm, maintaining position immediately below and ahead of the nose of the cloud (i.e., in the up-draught zone), or dipping briefly below the scud-roll as the storm moves along. The path to which they restrict their flights is so narrow that it can only indicate the up-draught region, and thus the presence of insects within that region.

SUMMARY

Of the various types of convective processes, thermal convection is the most important to insect distribution. Convective processes are the only kinds

whereby insects may be subjected to extremes of temperature. Previous experiments upon insect resistance to rapid freezings, with ice accretion, and partial thawings, when coupled with the known properties of convection, indicate that insects, other than soft-bodied forms, may withstand even thundercloud conditions.

With the exception of heat thunderstorms, and the special radiative effects of cities and woods, thermal convection is a diurnal phenomenon, and one would look for the maximum numbers of insects aloft at the afternoon peak of the process.

Convection is the only process by which insects attain considerable altitudes in the free atmosphere. It is possible to predict the altitudes attainable by an analysis of the air mass characteristics, and by generalizing with cloud-types. As a means of lengthy horizontal transport for insects, convection cannot be considered effective, although thunderstorms may act as a medium for the rapid redistribution of numerous insects over a wide area.

The use of various insect-feeding birds as indicators of zones or areas of insect abundance is described in connection with the discussion of the probable relative population density within and outside of convective currents.

LITERATURE CITED

1. Brancato, G. N. 1942. Meteorological behaviour and characteristics of thunderstorms. U. S. Dept. of Commerce, Washington, D. C.
2. Browne, J. A. 1942. Thunderstorm characteristics and flight procedure. Aeronautical Engineering Review, N. Y., 9.
3. Parman, D. C. 1920. Observations of the effect of storm phenomena on insect activity. Jour. Econ. Ent. 13 (4):339-343.
4. Shaw, N. 1930. The Physical processes of the weather. pp. 382-3.

NEW COLEOPHORIDAE (LEPIDOPTERA) *

BY J. McDUNNOUGH,
Ottawa, Ont.

The following new species were bred in the course of Insect Faunal Survey work carried on in various parts of Ontario.

Coleophora salicivorella n. sp.

Palpi deep smoky, pale whitish inwardly and narrowly along ventral edge of second joint; ventro-apical tuft on second joint well developed. Antennae with the basal joint deep smoky and slightly tufted, otherwise whitish, annulate with brown. Head and thorax deep gray. Primaries almost unicolorous deep smoky, somewhat shiny, with traces of light ochreous sprinkling along inner margin and in apical area; costal fringes concolorous, those on inner margin paler. Secondaries deep smoky with palish fringes. Abdomen blackish with pale anal tuft. Forelegs smoky, mid- and hindlegs largely whitish with smoky shading dorsally on the tarsi. Expanse 13 mm.

Genitalia. Male. In general quite similar to those of *kalmiella* McD. (1936, Can. Ent., LXVIII, 54, fig. 1). Sacculus rounded from ventral to caudal margin, terminating in a short, scoop-like projection, curved dorsad. Clasper short and narrow, projecting only slightly beyond sacculus. Valvula large and clothed with numerous short setae. Aedeagus cylindrical with the apical half armed on left side with numerous short spines, increasing in size distally.

*Contribution No. 2336, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

Vesica armed with a small, pointed, slightly spiculate spine. Gnathos small, upright.

Female. Lobes of genital plate small and widely separated, with convex and sparsely setose caudal margins. Ostium wide, semicircular, situated at cephalic margin of plate. Ductus bursae in its initial portion is a membranous tube with chitinized and spiculate sides; following this section is one of the usual blackish, spindle-shaped, heavily spiculate sections, similar in length to the first section; a short membranous portion follows which makes a large convolution to enter a narrowed, feebly spiculate and somewhat twisted section which terminates in the neck of the bursa and from which, proximally, the ductus seminalis arises. Bursa membranous, oval, with long, narrow neck and large anchor-like signum.

Larval Case. Consisting of three superimposed sections, very similar to that of *kalmiella* as figured (*op. cit.* p. 53). The cases occur on willow in the late fall, the larva feeding until the leaves are ready to drop. The cases probably fall to the ground with the leaves for hibernation; in the spring the larvae crawl around for a day or two without feeding and then attach themselves to some object for pupation, the moths appearing in late May or June.

Holotype—♂, Ottawa East, May 4, 1944 (J. McDunnough) (bred indoors from case on willow); No. 5605 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—4 ♂, same data, May 11, 26.

The above series represents all the adults obtained from about 22 cases, the larvae being very heavily parasitized by the Braconid *Agathis cinctus* (Cress.).

A single worn male from Indian Head, Sask. (June 30) is also in our Collection which, according to genitalia, falls here.

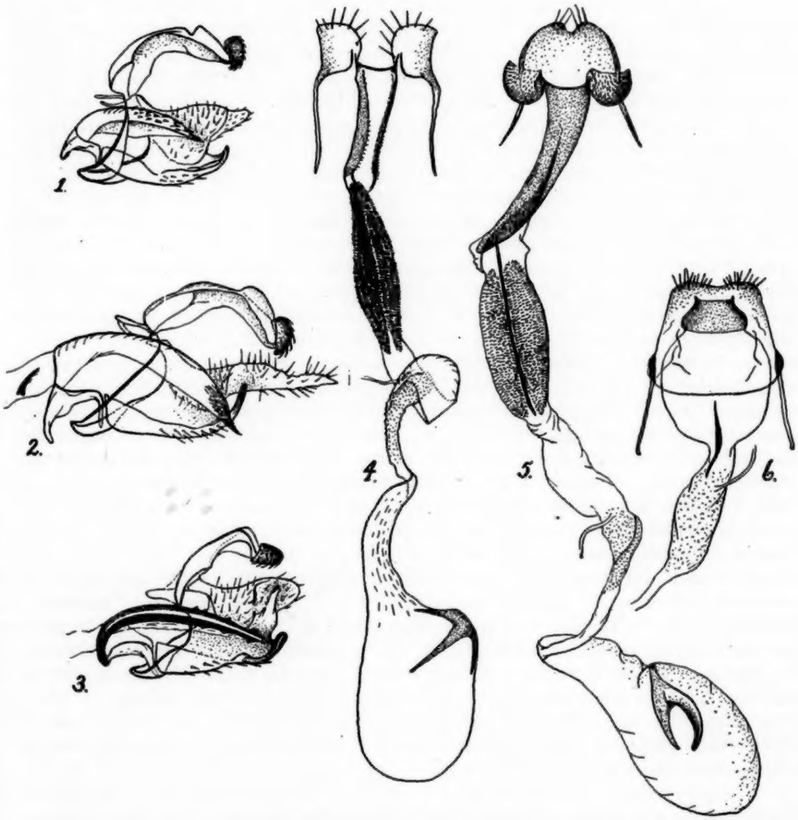
Coleophora cornivorella n. sp.

Palpi white with smoky suffusion on outer side on the apical half of the second joint and on the third joint; small apical tuft on second joint. Antennae white, faintly annulate on underside only, and with a slight white tuft on basal joint, suffused with smoky on underside. Head and thorax white, abdomen deep smoky with pale anal tuft. Primaries glistening white, rather variably suffused in the apical section with light brown or dull smoky generally more so in the females than in the males. Fringes smoky. Secondaries smoky with similarly colored fringes. Beneath all wings dull smoky. Fore- and midtibiae largely smoky on outer sides, hind tibiae white with tinges of smoky on tarsi. Expanse 11-12 mm.

Genitalia. Male. Sacculus with ventral margin rounding into the caudal margin and terminating in a long, upcurved, rod-like projection with blunt tip. Clasper long, thin and irregularly shaped with the lateral edges tuberculate with setal papillae and the apex drawn to a point, extending far beyond the sacculus. Valvula weak. Aedeagus cylindrical and much downcurved apically with only the left side chitinized and armed with a cluster of small spines at apex which terminates in a longer spine, bent toward the right. Vesica armed with a small cluster of closely appressed spines. Gnathos narrow, upright.

Female. Genital plate rather small with the lateral edges rounded inwardly toward apices and with the caudal edge showing a small median excavation. On each side of the plate at the cephalic margin are deep globular pockets, containing numerous fine hairs. Ostium a wide semicircular opening at cephalic margin leading into a horn-shaped, weakly chitinized initial portion of the ductus bursae which bends gradually to the left and opens out distally. With a half-bend to the right it is followed by a broader, cylindrical, darkly spiculate section with central ribbon of chitin. This, in turn, is followed by

a twisted, membranous section which narrows into a feebly spiculate tube from which the ductus seminalis arises and making a half-turn enters the apex of the bursa. This bursa is rather elongate, membranous and contains a large signum, composed of a strong, curved spine arising from the centre of a broad base, pointed at both ends.



Male Genitalia (left clasper removed) of 1. *Coleophora salicivorella* n. sp. 2. *C. cornivorella* n. sp. 3. *C. monardae* n. sp.
Female Genitalia of 4. *C. salicivorella* n. sp. 5. *C. cornivorella*. 6. *C. monardae* n. sp.

Larval Case. Of the *pruniella* type, composed of two sections with the junction generally quite obscure; rather short, cylindrical, dark in color and quite hirsute on its surface; apex flatly compressed; mouth deflected to about 45°. Feeds on *Cornus* sp. in late May and early June.

Holotype—♂, Turkey Point, Norfolk Co., Ont., June 26, 1944 (T. N. Freeman). (Bred from *Cornus*); No. 5606 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 1.

Paratypes—5 ♂, 2 ♀, same data, June 23, 26, 27, 29.

Closely allied in both maculation and genitalic characters with *gaylussaciella* Heinr., as identified for us by the author, although our specimens were bred at Ottawa from reddish cases on Sweet Fern (*Comptonia*). The non-annulate antennae on upper side and the considerably longer initial section of the ductus in the female genitalia characterize *cornivorella*.

Coleophora monardae n. sp.

Palpi with second joint moderately tufted, white, shaded with smoky-brown in the central area of the second joint, including the tuft, and along the ventral margin of the third segment. Antennae white, non-annulate; basal joint with slight tuft of white hairs, shaded faintly with smoky-brown dorsally and largely brown ventrally. Head and thorax white, at times with a faint grayish tinge. Primaries white, streaked faintly with ochre-brown longitudinal lines, one above inner margin and two subparallel ones from the cell outward to apex and outer margin of wing. Below the costo-apical fringes are four short smoky streaks, forming a broken line and slightly bordered with ochreous-brown. A few scattered smoky scales between the central brown lines. Costal and apical fringes pale with faint brown tinges, other fringes pale smoky. Secondaries smoky with paler fringes. Beneath deep smoky with pale costo-apical fringes. Forelegs deep smoky outwardly, pale beneath; midlegs largely whitish, suffused with smoky on femora and tarsi; hindlegs white with dark streak along outer side of tibia and dark shading on tarsi. Expanse 11-13 mm.

Genitalia. Male. Small and chunky. Sacculus with ventral margin terminating in a broad, scoop-shaped projection, curved dorsad; caudal margin produced into a long rod-like process, with slightly recurved apex, which almost reaches to dorsal margin of clasper. The short, broad clasper hardly extends beyond apex of sacculus. Valvula broad with slightly raised caudal margin, strongly setose. Aedeagus broad and rounded at base, rather shallow, armed with two flat lateral rods of chitin each of which shows a flat preapical tooth, a smaller median tooth and one or two minute teeth nearer base. Vesica unarmed. Gnathos oval, projected caudad.

Female. Genital plate broad with feebly sinuate caudal margin. Ostium situated close to caudal margin, broadly bowl-shaped, lightly chitinized. The initial section of the ductus bursae forms a large membranous globe, extending well below the cephalic margin of the genital plate; it narrows to a moderately wide, somewhat twisted, slightly spiculate membranous tube, a thin chitinous ribbon running from the lower portion of the globe into this tube for a short distance and below which is the exit of the ductus seminalis; this tube narrows later into a very fine tube which runs straight to the narrow oblong unarmed bursa.

Larval Case. Quite similar to the case of *granifera* Brn., being slender, brown, with a blackish patch dorsally above the mouth. It differs, however, in the apex being three-valved and not flatly compressed as in *granifera*. The mature cases occur in early June on *Monarda*.

Holotype—♂, Turkey Point, Norfolk Co., Ont., July 14, 1944 (T. N. Freeman) (bred from *Monarda*); No. 5607 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 3.

Paratypes—3 ♀, same data, July 10, 12, 14.

The species should probably be placed next to *granifera* Brn. and *asterosella* McD., having a very similar type of maculation but quite distinctive genitalia. The larvae were heavily parasitized by an *Orgilus* sp.

NEW DESCRIPTIONS OF LARVAE OF FOREST INSECTS: LARVAE OF THE GENUS *EUPITHECIA* (LEPIDOPTERA, GEOMETRIDAE) *

BY W. C. McGUFFIN,
Winnipeg, Manitoba.

During the last seven years, larvae representing more than a dozen species of the genus *Eupithecia* have been received by the Forest Insect Survey of Canada. With the hope that some of these larvae may be recognized more readily, two species are described herewith; additional notes are given on three species already described, and a key for the separation of mature larvae of these five species is presented at the end of this article.

Eupithecia luteata Pack.

Penultimate Instar: Width of head 0.50 to 0.65 mm. Body 10 to 12 mm. in length and 0.8 to 1.0 mm. in width. Ground colour of body brownish-yellow. Middorsal line a dark, greyish-brown stripe, geminate on the thorax; subdorsal line brown; spiracular line light brown; subspiracular line dark brown; subventral line whitish and midventral line brown. Head dirty yellow with light brown herring-bone markings along the epicranial stem and on the genae.

Ultimate instar: Width of head 0.92 to 0.97 mm. Body 10 to 12 mm. in length and 1.0 to 1.3 mm. in width. Integument covered with small convex granules, amongst which are scattered larger conical and convex granules. Ground colour of body dirty yellow to yellowish-brown. Middorsal line grey to greyish-purple, somewhat thicker in anterior portion of segment than in posterior, and geminate on thorax. Subdorsal line yellow through orange to greyish-orange. Spiracular line yellow, borne on a ridge; subspiracular line brown. Subventral line white to light grey; midventral line brown to reddish-brown. Some larvae have bands of greyish-purple on the anterior third of the first five or six abdominal segments. The head, covered with low convex granules, varies from light yellow to dirty yellow. Adfrontal suture light, sinuate; adfrontals and frons light brown, slightly darker than the adjacent areas of the head. Epicranial index 0.7 to 1.3. Distance between ocelli 1 and 2 approximately equal to that between ocelli 2 and 3. Postclypeus light brown; preclypeus grey; labrum brown, shallowly notched at an angle of 120 degrees. Prothoracic shield of ground colour, with middorsal and subdorsal lines present. Anal shield of ground colour, yellow at sides, crossed by middorsal line. Setigerous tubercles small brown papillae set directly on the skin; setae fairly long, light brown. Spiracles round, yellow with fine brown rims. Thoracic legs hyaline to light brown; ventral prolegs dirty yellow, with 18 to 26 crochets, and anal prolegs light orange to reddish-brown.

Less detailed but very good descriptions of larvae of *E. luteata* Pack. are given by Packard (3). It is interesting to note that he also saw the banded form of this larva.

Mouthparts: Mandibles much like those of *E. palpata* and *E. gibsonata* (2), light brown, usually with two ridges and six teeth. Hypopharynx conical with the lingua bare, gorge spiny, and the maxillulae tomentose. Spinneret conical, rounded at tip. Labial palpi with the segments in the proportion of 3.3:1:2.3.

Food Plants: White spruce, hemlock, tamarack, and balsam.

Eupithecia fletcherata Tayl.

Ultimate Instar: Width of head 0.92 to 1.1 mm. Body 13 mm. in length and 1.0 to 1.5 mm. in width. Integument of the body densely covered with

---

*Contribution No. 2364, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

small, convex granules interspersed amongst which are larger yellow ones, both conical and convex. Ground colour yellow-brown to orange. Middorsal line dark grey, occasionally greyish-red; geminate on thorax; this line broadened into diamond-shaped patches on abdominal segments one to six inclusive. These patches touching the grey or rust-coloured subdorsal line, which is more or less broken in some places but thickened in others; viz., on abdominal segments one to six to form grey diagonal patches or obliques. These obliques, running posteriorly and laterally from seta alpha to the subdorsal line, flanked on the lower, anterior side by the yellow or orange spiracular line. This line, on which the prothoracic and seventh and eighth abdominal spiracles are placed, running above and posterior to the other abdominal spiracles; these other abdominal spiracles set in dark grey obliques. The spiracle-bearing obliques joining the subspiracular dark brown stripe. Subventral line a light stripe; midventral line bright to ruddy-brown, often broken. The head, densely covered with small, low, convex granules, varying from dirty yellow to brown, with a light line over each vertex and dark brown herring-bone markings along the epicranial stem. Adfrontal suture light, wavy; adfrontals, frons, preclypeus, and labium some shade of brown; postclypeus grey. Epicranial index 0.8 to 1.6. Distance between ocelli 1 and 2 approximately equal to that between ocelli 2 and 3. Prothoracic shield concolorous with dorsum; middorsal and subdorsal lines crossing it, the latter often broadened out. Anal shield reddish, with broad middorsal line continued across it almost to tip; edges light. Setigerous tubercles are convex papillae set directly on the skin; the setae light and fairly long. Spiracles light or dark, circular, with brown rims. Thoracic legs light; prolegs light brown; ventral proleg, bearing 10 to 12 crochets, frequently with a rosy suffusion, while the anal has a brown patch on the outer side.

Mouthparts: Mandibles and hypopharynx much like those of other *Eupithecia* larvae studied (2); labial palpi with segments in the proportion of 3:1:1.5.

Food Plants: Tamarack; white, black, and red spruce.

Eupithecia filmata Pears.

As a good description of the patterned form of this larva has been given by McDunnough (1), only a description of the striped form and measurements of all individuals studied are presented here.

Ultimate or Fourth Instar: Width of head 0.96 to 1.1 mm. Body 12 to 15 mm. in length and 1.0 to 2.0 mm. in width. Integument of the body covered with small conical granules amongst which are scattered large convex ones. Ground colour brick-red to brown. Middorsal line greyish ground colour; subdorsal line brown, of even width throughout its length. Spiracular line yellow; subspiracular line pale pink to brown. Subventral line light; midventral line fine, brick-red, sometimes broken. The head, covered with small convex granules, is light brown. Adfrontal suture light, sinuate. Epicranial index 1.3 to 1.5. Distance between ocelli 1 and 2 equal to that between ocelli 2 and 3. Prothoracic shield concolorous with dorsum, bearing middorsal and subdorsal lines. Anal shield ground colour with yellow edges. Setigerous tubercles low, convex papillae set directly on the skin; setae short to medium, dark. Thoracic legs light yellow through reddish-orange to brown; prolegs orange to brown, the ventral bearing 10 to 24 crochets.

Mouthparts: Mandibles and hypopharynx much like those of *E. palpata* and *E. gibsonata*. Labial palpi with the segments in the proportion of 2.3:1:1.7 to 2:1:1.6.

Food Plants: Spruce, balsam, hemlock.

Eupithecia palpata Pack.

To the description of this larva already given (2), a few more notes on

the mouthparts can now be added. The mandibles are usually without a notch in the sixth tooth, and the teeth are usually less acute than shown in the illustration. Although ocassionally the maxillulae and gorge of the hypopharynx are bare as mentioned, usually the maxillula is tomentose and the gorge, spiny. Labial palpi have the segments in the proportion of 2:1:2 to 3:1:2.3.

Eupithecia gibsonata Tayl.

In most cases it seems impossible to distinguish between the mandibles of this species and those of others discussed in this paper but sometimes, as mentioned in the original description (2), the mandibles have longer, more acute teeth than in *E. palpata*.

KEY TO LARVAE OF THE GENUS *EUPITHECIA*

1. Larvae with diamond-shaped markings on the dorsum 2
   Larvae with lines only, no patterns on the dorsum 3
2. Larvae with well developed light and dark obliques on the sides of abdominal segments one to five or six; herring-bone markings on the head .... *fletcherata*
   Larvae with no obliques on the sides, but with horizontal bars on abdominal segments one to five or six; markings on head usually not arranged in herring-bone pattern .... *filmata*
3. Larvae predominantly green .... *gibsonata*
   Larvae orange to brown 4
4. Midventral line light .... *palpata*
   Midventral line dark 5
5. Midventral line narrow, frequently broken, reddish (in living larvae); larvae feed in spring and early summer .... *filmata*
   Midventral line wider, brown; larvae feed in late summer and earl fall .... *luteata*

REFERENCES

1. McDunnough, J. H. (1942) Notes on the early stages of two *Eupithecia* species. Can. Ent. 74:202-203.
2. McGuffin, W. C. (1942) New descriptions of larvae of forest insects: V. Can. Ent. 74:150-153.
3. Packard, A. S. (1890) Fifth Report of the Entomological Commission. Pp. 865-866 and 874-875.

A NEW RECORD FOR CANADA (LEPIDOPTERA)

Three specimens of an interesting species, *Acentropus niveus* Olivier of the subfamily Schoenobiinae, have been captured at Montreal in the Province of Quebec, apparently the first known occurrence in Canada of this European species. The adults, which have pale grayish primaries and white secondaries without any particular maculation and an expanse of approximately 11 mm., resemble superficially some of the Trichoptera. They were taken by the writer on August 2, 1927, and on August 1 and 3, 1944, the latter two at electric light.

The species, identified through the kindness of Dr. Wm. T. M. Forbes of Cornell University, has only once before been recorded for North America, Dr. Forbes having obtained a specimen at Oswego, New York, and having published, in 1938, a record of its occurrence in the Journal of the New York Entomological Society.

A. C. Sheppard, Montreal, Que.

A NEW SPECIES OF *OBEREA* FROM CANADA (COLEOPTERA, CERAMBYCIDAE)

BY W. S. FISHER,
Bureau of Entomology and Plant Quarantine, Washington, D. C.

In a collection of *Oberea* received from S. D. Hicks for identification the following new species was found.

Oberea canadensis n. sp.

Male. Rather slender, subcylindrical; uniformly brownish yellow except antennae, tips of mandibles and palpi, four round spots on pronotum, a narrow vitta near lateral margins of elytra, a small, round spot on each side of prosternum, a small spot on mesosternal episternum, an elongate spot along inner margin of metasternal episternum, a large triangular spot on each side along outer margin of mesosternum, the tarsi, and the tibiae in part, which are black.

Head subequal in width to pronotum at middle; front quadrate, nearly flat, broadly, shallowly concave between antennal tubercles, with a vague, longitudinal groove or carina extending from clypeus to occiput; surface coarsely, densely, deeply punctate, with numerous fine punctures on intervals, rather densely clothed with short, recumbent, white hairs, with a few erect, black hairs intermixed. Antenna three-fourths as long as body, finely rugose, rather densely clothed with short, recumbent, whitish hairs.

Pronotum as long as wide, subequal in width at base and apex; sides slightly expanded at middle; disk slightly gibbose behind middle; surface shallowly, transversely depressed along base and anterior margin, coarsely, deeply, confluently punctate, with numerous fine punctures on intervals, rather densely clothed with short and long erect, inconspicuous, white hairs, and ornamented with four round, glabrous, black spots, two arranged transversely in front of middle, and one on each side along lateral margin behind middle.

Elytra scarcely wider than pronotum; sides nearly parallel, vaguely constricted along middle, broadly, obliquely truncate at apices; disk slightly flattened; surface coarsely, deeply punctate, the punctures distinctly separated and arranged in more or less distinct rows on disk, more confluent toward sides, rather densely, uniformly clothed, with short, recumbent, white hairs, which do not obscure the surface.

Body beneath very finely, densely granulose, finely, irregularly punctate, rather densely clothed with short, recumbent, yellow or white hairs, with a few long, erect hairs intermixed; last abdominal sternite very broadly, deeply concave posteriorly, broadly subtruncate or feebly emarginate at apex, with numerous erect, black hairs at outer angles of emargination. Posterior femora extending to posterior margin of second abdominal sternite.

Length 11.5 - 13mm., width 2.5 - 3 mm.

Type locality. Ojibway, Ontario, Canada.

Type. U. S. National Museum No. 57254. Paratype in the Canadian National Collection.

Described from two males (one type) collected at the type locality on *Salix* sp., July 1, 1943, by S. D. Hicks.

This species is allied to *Oberea gracilis* (Fabricius) and *Oberea myops Haldeman.* It differs from *gracilis* in having the antennae black, and the pronotum and underside of the body ornamented with black spots, and from *myops* in having four round, black spots on the pronotum instead of two, and the last abdominal sternite more broadly but not so deeply concave toward the apex.

GUELPH PRINTING SERVICE

Mailed Saturday, July 7th, 1945.

,
r
s
y

s
l-
y,
y
d
of

n-
t-
nd
er
b-

te,
ew
ve
us
to

Na-

lix

ops
pro-
ops
last